

CLAIMS

1. A method of making a crystalline metal oxide powder material comprising two or more metal elements combined in uniform proportions with oxygen in the crystal structure, said method comprising:

combining water soluble, crystalline, water containing, oxygen containing inorganic acid salt compounds of at least two of said metals into a body of crystals that contains said two metals in separate compounds;

heating the body of crystals to remove the water from the crystals and form a liquid mixture containing said water and a uniform distribution of said metal elements;

removing the water to form a dry mixture of metal acid salt compounds; and

heating the dry mixture to decompose said acid to leave a powder residue of said metal oxide powder material.

2. The method as recited in claim 1 in which at least two of said metals are initially contained in hydrated nitrate or hydrated nitrite compounds.

3. The method as recited in claim 2 in which said metal oxide powder comprises two or more metals selected from the group consisting of aluminum, cobalt, lithium, nickel, magnesium and manganese.

4. The method as recited in claim 3 in which said water containing, crystalline, oxygen containing inorganic acid salt compounds are selected from the group consisting of $\text{LiNO}_3 \cdot \text{H}_2\text{O}$, $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, and $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$.

5. A method of synthesizing a LiNiO_2 type crystalline material of $\text{Li}(\text{Ni}_x \text{M}_{1-x})\text{O}_2$, where M is one or more dopant metals for said crystalline material and $0.5 \leq x \leq 0.7$, said method comprising:

combining water soluble, crystalline, oxygen containing inorganic acid salt compounds of each of lithium, nickel and at least one of said dopant metals into a body of crystals where at least two of said salt compounds contain water;

heating the body of crystals to remove the water from the crystals and form a liquid mixture containing said water and a uniform distribution of Li, Ni and said dopant metals;

removing the water to form a dry mixture of metal salt compounds; and

heating the dry mixture to decompose said acid to leave a powder residue of said $\text{Li}(\text{Ni}_x \text{M}_{1-x})\text{O}_2$ material.

6. The method as recited in claim 5 in which dopant metals are selected from the group consisting of aluminum, cobalt, magnesium and titanium, said titanium being used as titanium dioxide.

7. The method as recited in claim 5 in which each of said inorganic acid compounds is a nitrate or nitrite compound.

8. The method as recited in claim 6 in which each of said inorganic acid compounds is a nitrate or nitrite compound.

9. The method as recited in claim 7 in which said nitrate compounds are selected from the group consisting of $\text{LiNO}_3 \cdot \text{H}_2\text{O}$, $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, $\text{Al}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$, and $\text{Mg}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$.

10. A method of synthesizing a LiNiO₂ type crystalline material of Li (Ni_x M_{1-x}) O₂, where M is one or more dopant metals for said crystalline material and 0.5 ≤ x ≤ 0.7, said method comprising:

combining water soluble, crystalline, nitrate or nitrite compounds of each of lithium, nickel and at least one of said dopant metals into a body of crystals where at least two of said nitrate or nitrite compounds contain water;

heating the body of crystals to remove the water from the crystals and form a liquid mixture comprising a solution containing said water and a uniform distribution of Li, Ni and said dopant metals;

removing the water to form a dry mixture of metal salt compounds; and

heating the dry mixture to decompose said acid to leave a powder residue of said Li (Ni_x M_{1-x}) O₂ material.

11. The method as recited in claim 10 in which said nitrate compounds are selected from the group consisting of LiNO₃·H₂O, Ni(NO₃)₂·6H₂O, Co(NO₃)₂·6H₂O, Al(NO₃)₃·9H₂O, and Mg(NO₃)₂·6H₂O.